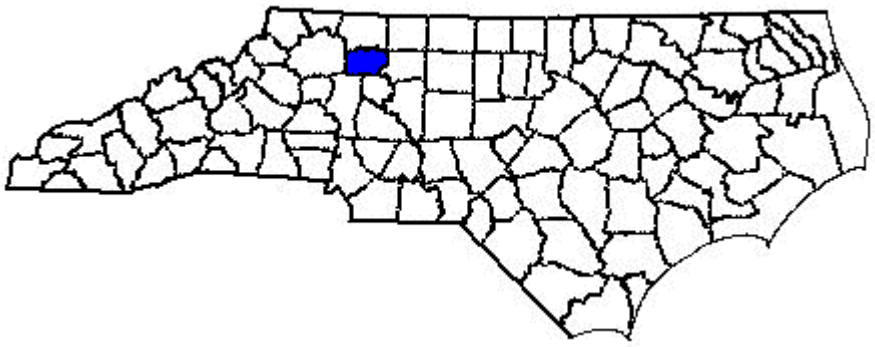
ANNUAL REPORT FOR 2002



Bethel Church Mitigation Site

Yadkin County

Project No. 6.779004T

TIP No. R-2120WM

Prepared By:
Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Bethel Church Mitigation Site. Site construction began in December 2000 and was completed in February 2001. Monitoring activities in 2002 represent the second year of monitoring for the site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years.

The site contains six monitoring gauges (5 in the restoration areas, 1 in the existing wetland area), one rain gauge and four vegetation plots.

The daily rainfall data depicted on the monitoring gauge graphs is recorded from an on-site rain gauge. An off-site rain gauge recorded at Yadkinville, maintained by the NC State Climate Office, contributed to the daily rainfall data and historical rainfall data used for the 30-70 percentile. Hydrologic monitoring indicated that four of the six gauges on site showed saturation for over 12.5% of the growing season. One gauge (GW-5) showed saturation between 8 – 12.5% of the growing season and the remaining gauge (GW-2) showed saturation between 5% and 8% of the growing season.

In January 2002, the enhancement area was supplementary planted. Vegetation success requires 320 trees/acre of the target species surviving at the end of the first three years. The total density average is 438 trees per acre, which is well above the success criteria of 320 trees per acre.

Based on the monitoring results from the 2002 growing season, NCDOT recommends that monitoring continue.

1.0 Introduction

1.1 Project Description

The Bethel Church Mitigation Site is located on US 421 east of Yadkinville adjacent to an unnamed tributary of South Deep Creek in Yadkin County (Figure 1). This site mitigates for wetland impacts associated with the improvements to US 421 New Location (R-2120AB).

The Bethel Church Mitigation Site is divided into two parcels (North and South), totaling approximately 8.0 acres (ac) in size. The site consists of 3.03 ac of the restoration of a bottomland hardwood wetland restoration, 0.8 ac of wetland enhancement, 850 feet of stream restoration and 4.2 ac of upland buffer. Site construction began in December 2000 and was completed in February 2001. The site was initially planted in March of 2001. In January 2002, the enhancement area was supplementary planted.

In addition to the original mitigation plan, the Department purchased Lots 1-20, which are adjacent parcels of land to the west of Fox Drive between the unnamed tributary and extend to the north up to the Control Access along US 421. These parcels are completely wooded, consisting of upland forest and bottomland hardwood floodplain sections adjacent to the stream. By acquiring these parcels, the fill material associated with Fox Drive was completely removed to match the wetland mitigation site contours. The in-stream culvert was also removed during construction.

1.2 Purpose

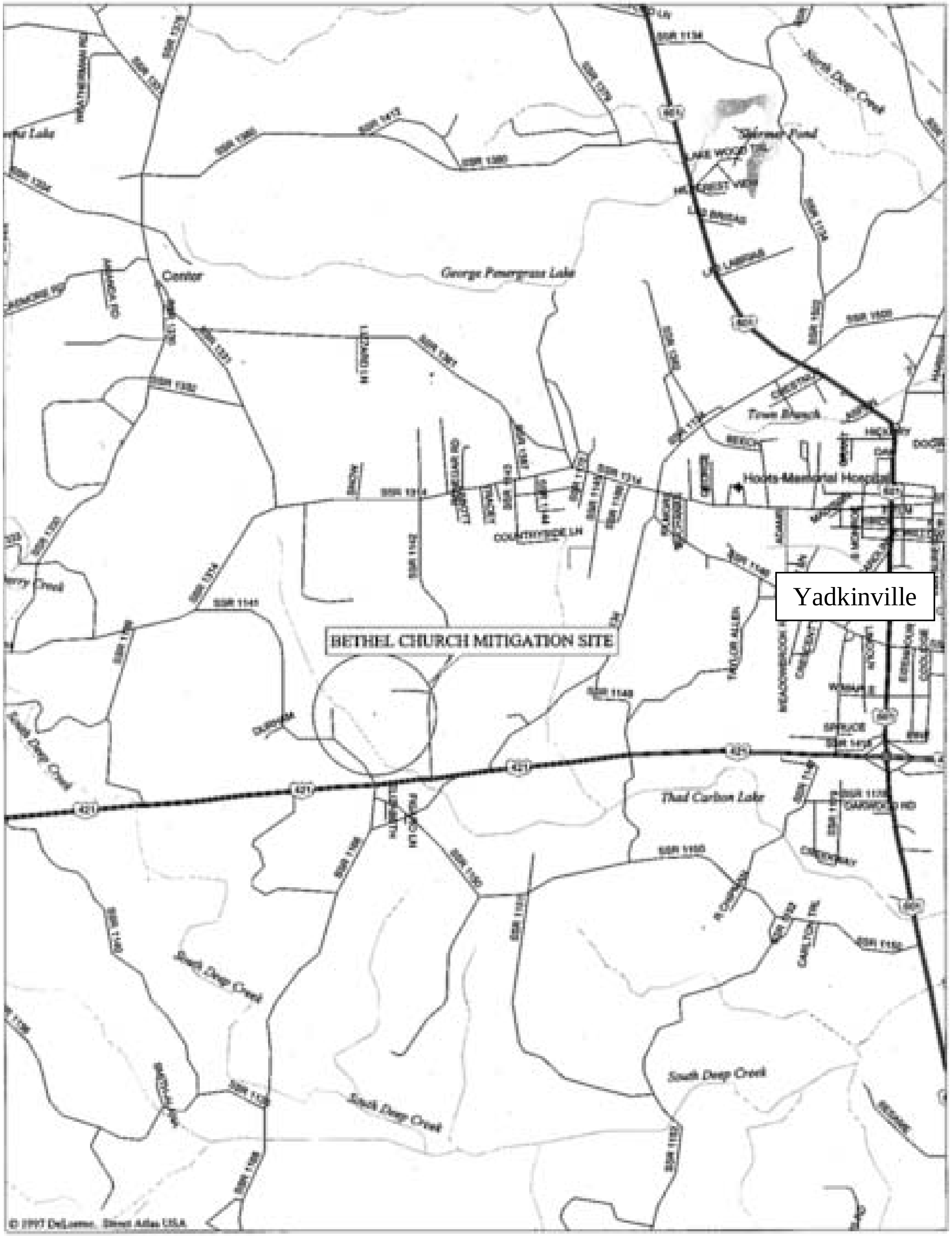
In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria for hydrology and vegetation are based on the approved mitigation plan dated August 1998. The following report details the results of hydrologic and vegetative monitoring activities that were performed during the 2002-growing season at the Bethel Church Mitigation Site.

Activities in 2002 reflect the second year of monitoring following the restoration efforts. This document includes analyses of both hydrologic and vegetative monitoring throughout the growing season.

1.3 Project History

August 1998	Mitigation Plan
December 2000 - February 2001	Site Construction
March 2001	Site Planted
March 2001	Monitoring Gauges Installed
October 2001	Hydrologic Monitoring
July 2001	Vegetation Monitoring (1 yr.)
January 2002	Supplementally Planted Enhancement Area
August 2002	Vegetation Monitoring (2 yr.)
April-October 2002	Hydrologic Monitoring (2 yr.)

Figure 1. Site Location Map



2.0 HYDROLOGY

2.1 Success Criteria

Per the mitigation plan dated August, 1998, Surface and groundwater hydrology of the Bethel Church mitigation site will be monitored for five years following the completion of all implementation activities, or until hydrologic success criteria are met. Hydrologic success for this site is defined as the presence of the water table within 12 inches of the soil surface for 5-12 % of the growing season during a normal rainfall year.

The growing season in Yadkin County begins April 9 and ends October 28. These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after April 9 and before October 28.[1] The growing season is 202 days; therefore, optimum hydrology requires 12.5% of this season, or at least 25 consecutive days. Local climate must also represent average/normal conditions for the area.

2.2 Hydrologic Description

In March 2001, six monitoring gauges were installed across the site (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth. This represents the second growing season that the monitoring gauges have been in place since construction of the site.

The Bethel Church site was designed to restore the natural flooding regime of the headwater stream. Hydrology for the site is naturally dominated by over-bank flooding of the small unnamed tributary of South Deep Creek. The hydrologic monitoring should show the reaction of the groundwater level to specific rainfall events and the extent of ponding that may be attributed to over-bank flooding.

Figure 3 represents a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 12.5% of the growing season. Gauges highlighted in green show hydrology between 8% and 12.5% of the season. Those gauges highlighted in red indicate wetland hydrology between 5% and 8%.

[1] Soil Conservation Service, Soil Survey of Yadkin County, North Carolina.

FIGURE 2: BETHEL CHURCH MITIGATION PLAN

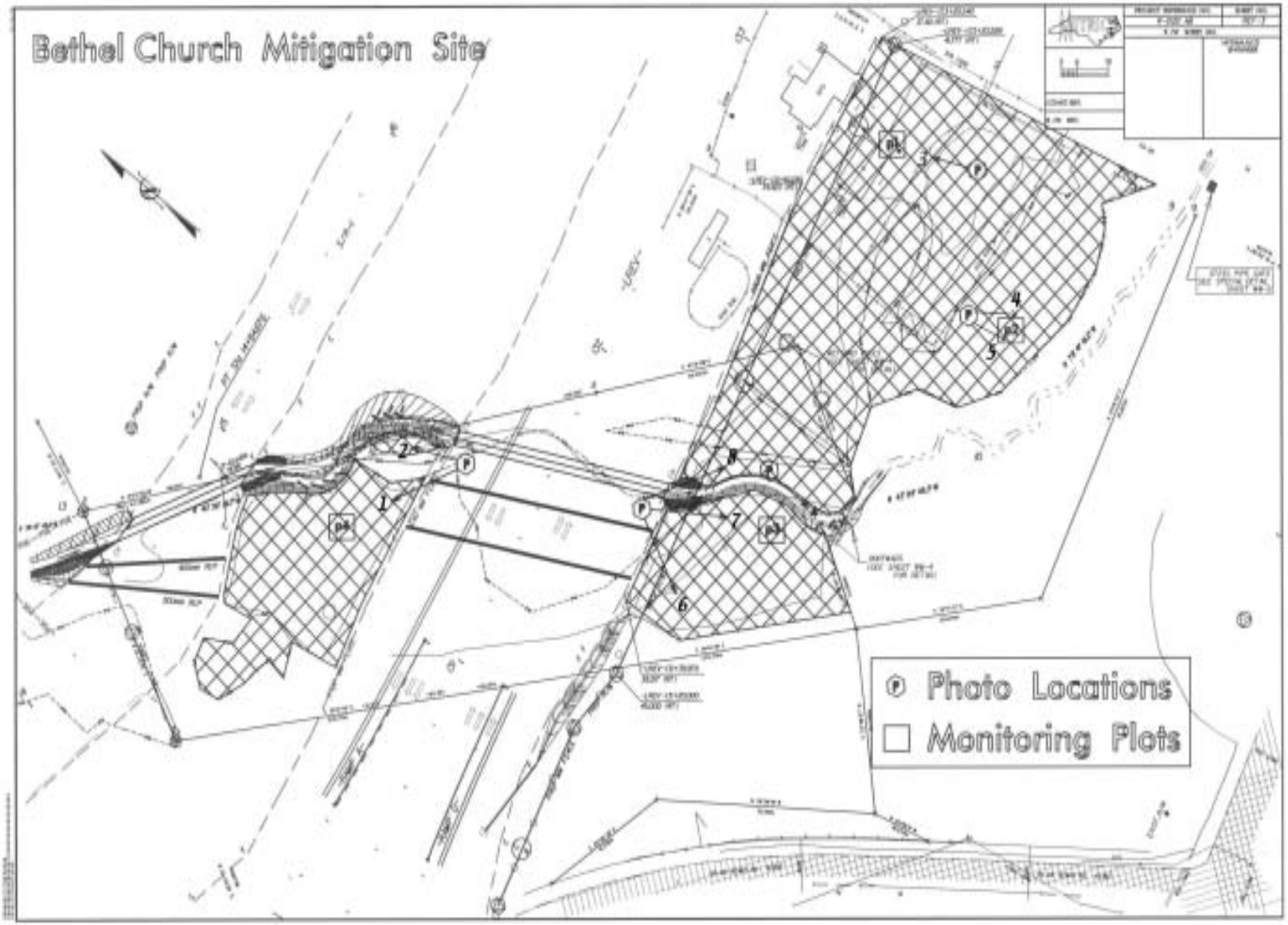
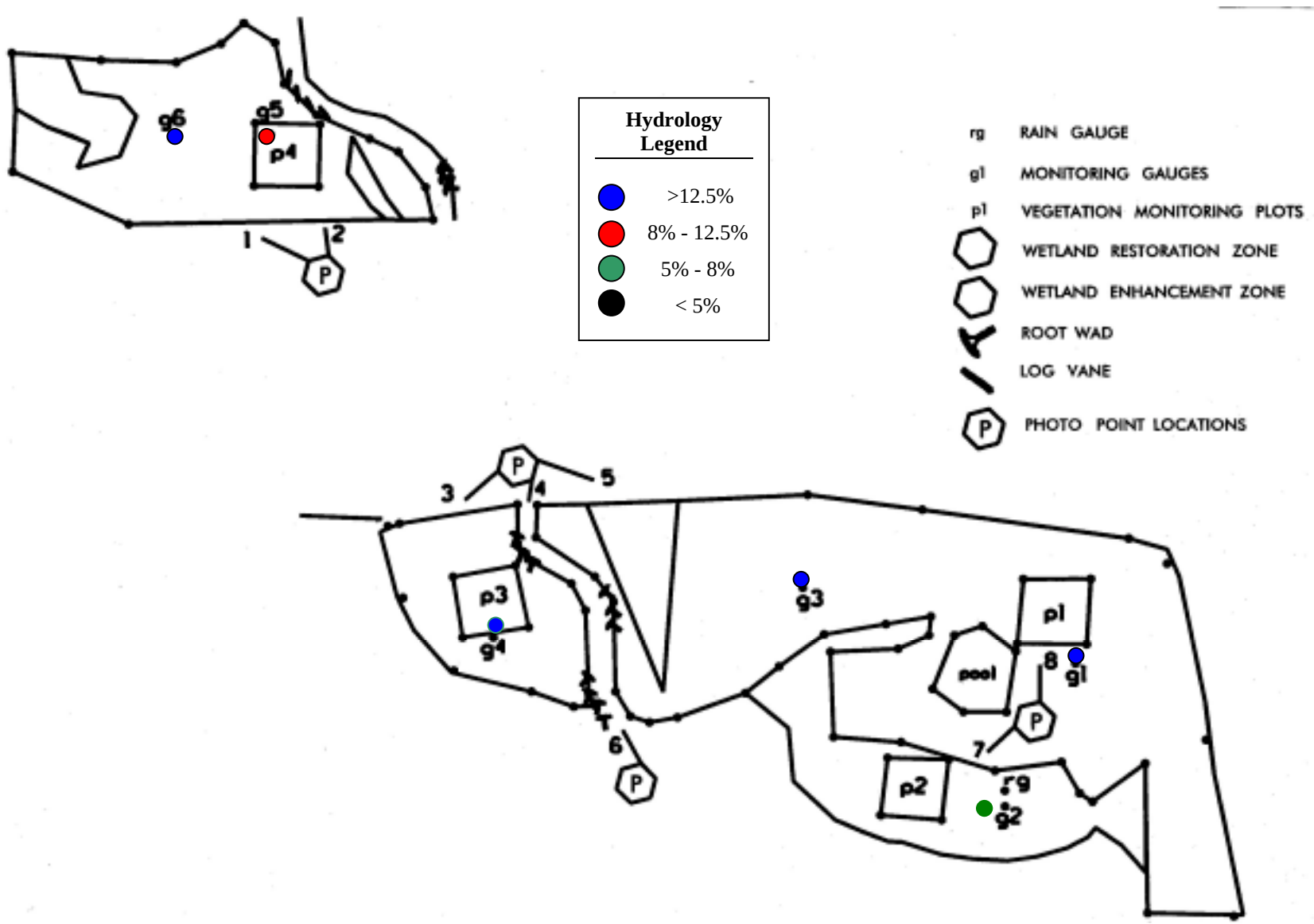


FIGURE 3: BETHEL CHURCH MONITORING PLAN & 2002 GAUGE RESULTS



2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each gauge. This number was converted into a percentage of the 202-day growing season. The results are presented in Table 1.

Appendix A contains a plot of the groundwater depth for each monitoring gauge. The maximum number of consecutive days is noted on each graph. An onsite rain gauge was used to obtain rainfall data from the site. It has been compared with rainfall data obtained from the State Climate Office Local Weather Station in Yadkinville, which is approximately 2 miles from the mitigation site.

Table 1. Bethel Church Hydrologic Monitoring Results.

Monitoring Gauge	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %*	Success Dates
GW-1*				**X**	**15.76**	Sept. 27 – Oct. 28
GW-2 (Existing Wetland)		**X**			**8.87**	May 2 – May 19
GW-3				**X**	**24.14**	Apr. 9 – May 27
GW-4				**X**	**100**	Apr. 9 – Oct. 28
GW-5			**X**		**9.85**	May 2 – May 21
GW-6				**X**	**23.65**	Apr. 9 – May 26

* Gauge met the success criteria during an above average rainfall for the month of October.

Specific Gauge Problems:

- GW-6 stopped recording data on 9/4/02. The gauge was replaced and programmed to record data starting on 10/8/02.

2.3.2 Climatic Data

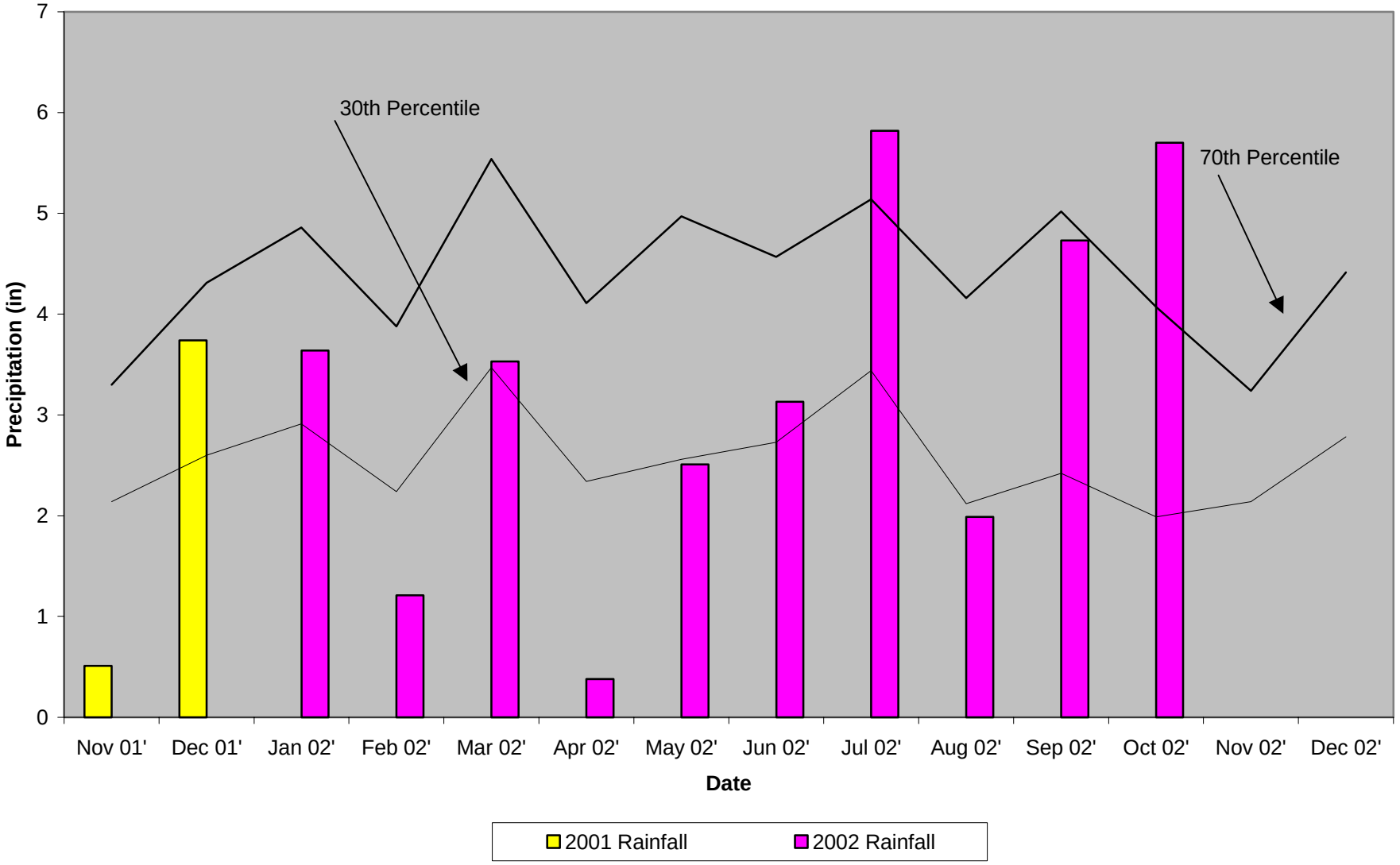
Figure 4 represents an examination of the local climate in comparison with historical data in order to determine whether 2002 was "average" in terms of precipitation. The two lines represent the 30th and 70th percentiles of monthly historical precipitation at the Yadkinville Station. The bars represent the monthly rainfall totals for 2002. February, April, May, and August experienced below average rainfall. The months of January, March, June, and September all recorded average rainfall for the site. Only July and October experienced above average rainfall. No data is available for November or December.

2.4 Conclusions

The 2002 growing season represents the second monitoring assessment period for the Bethel Church mitigation site since construction. It is concluded that with overall rainfall for 2002 being below average, the site met success criteria and exceeded the data from the gauges in existing wetland.

Hydrologic monitoring will continue for 2003 at the Bethel Church Mitigation Site.

Bethel Church 30-70 Percentile Graph 2002
Yadkinville, NC



3.0 VEGETATION: BETHEL CHURCH MITIGATION SITE (YEAR 2)

3.1 Success Criteria

Success criteria are defined as 320 trees/acre of the target species surviving at the end of three years, and 260 trees/acre of the target species surviving at the end of five years.

3.2 Description of Species

The following species were planted in the Wetland Restoration Area:

Carya cordiformis, Bitternut Hickory

Fraxinus pennsylvanica, Green Ash

Platanus occidentalis, Sycamore

Quercus nigra, Water Oak

Quercus palustris, Pin Oak

Quercus phellos, Willow Oak

Quercus rubra, Northern Red Oak

3.3 Results of Vegetation Monitoring

Plot #	Bitternut Hickory	Green Ash	Sycamore	Water Oak	Pin Oak	Willow Oak	Northern Red Oak	Total (2 year)	Total (at planting)	Density (Trees/Acre)
1		5	10	7		5	3	30	36	567
2		13	3	2	1		7	26	40	442
3		13			1	10		24	51	320
4		15	1	2		10		28	45	423
								AVERAGE DENSITY		438

Site Notes: Other species noted: foxtail, ragweed, red maple, *Juncus* sp., *Sagittaria* sp., smartweed, *Carex* sp., cattail, woolgrass, pokeweed, silky dogwood, black willow, multi-flora rose, poison ivy, volunteer green ash, lespedeza, goldenrod, river birch, and alder. Plot 2 had heavy growth competition, which made it difficult to find trees. Northern Red Oak was noted growing in higher elevations of the site.

3.4 Conclusions

NCDOT mowed the site around plots 1 and 2. Red maples in the enhancement area (area around plot 2) were cut and treated with oust in December 2001. Trees were supplementally planted in the area around plots 1 and 2 in January 2002. The total density average is 438 trees per acre, which is well above the success criteria of 320 trees per acre.

The stream channel was visually monitored during the annual vegetation monitoring of the site. The streambank was mostly vegetated with herbaceous vegetation and stable throughout the length of the channel. Photos 9 through 16 show the conditions of the stream. No remedial actions are necessary. NCDOT will continue vegetation monitoring at the Bethel Church Mitigation Site.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

The Bethel Church Mitigation Site has met the success criteria prescribed in the mitigation plan for the site, even though rainfall for the entire growing season was below normal. All gauges on-site met or exceeded the gauge installed in the existing wetland.

The site currently meets vegetative and hydrologic success criteria. NCDOT proposes to continue all monitoring for 2003.

APPENDIX A

DEPTH TO GROUNDWATER GRAPH

APPENDIX B

SITE PHOTOS

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9 (Stream)

Photo 10 (Stream)

Photo 11(Stream)

Photo 12 (Stream)

Photo 13 (Stream)

Photo 14 (Stream)

Photo 15 (Stream)

Photo 16 (Stream)